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EXAMINER	
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1796	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/559,905	KHABASHESKU ET AL.	
	Examiner	Art Unit	
	Michael J. Feely	1796	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *13 August 2008*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-91* is/are pending in the application.

4a) Of the above claim(s) *73-91* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-20,40-58,71 and 72* is/are rejected.

7)☒ Claim(s) *21-39 and 59-70* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *08 December 2005* is/are: a)☐ accepted or b)☒ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *20070416*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Pending Claims

Claims 1-91 are pending.

Election/Restrictions

1. Applicant's election without traverse of Group I (claims 1-72) in the reply filed on August 13, 2008 is acknowledged.

2. Claims 73-91 are withdrawn from further consideration pursuant to 37 CFR 1.142(b) as being drawn to a nonelected invention, there being no allowable generic or linking claim. Election was made **without** traverse in the reply filed on August 13, 2008.

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

4. Claims 1-9, 12, 13, 40-49, 52, 53, 71, and 72 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sandler et al. *(see IDS entry no. 24)* in view of Tour et al. (WO 02/060812 A2). *Note: Tour et al. was cited as an "X-reference" in the international search report.*

Regarding claims 1-9, 12, and 13, Sandler et al. disclose: ***(1)*** a method comprising the steps of: (a) dispersing CNTs in a solvent to form a dispersion (page 5968, right column: 2nd full paragraph); (b) adding epoxy resin to the dispersion to form a mixture (page 5968, right column:

2nd full paragraph); (c) removing solvent from the mixture to form a largely solvent-free mixture (page 5968, right column: 2nd full paragraph); (d) adding curing agent to the solvent-free mixture (page 5968, right column: 2nd full paragraph); and (e) curing the solvent-free mixture to form a CNT-epoxy composite (page 5968, right column: 2nd full paragraph), wherein the CNTs are dispersed and integrated into the epoxy matrix (page 5968, right column: 2nd full paragraph);

(2) wherein the step of dispersing involves ultrasonication (page 5968, right column: 2nd full paragraph);

(3) wherein the solvent is selected from the group consisting of aqueous solvents, non-aqueous solvents, and combinations thereof (page 5968, right column: 2nd full paragraph);

(4) wherein the epoxy resin is selected from the group consisting of DGEBA, Novolac epoxy, cycloaliphatic epoxy, brominated epoxy, and combinations thereof (page 5968, right column: 1st full paragraph);

(5) wherein the step of adding comprises a mixing of the mixture components (Abstract; page 5968, right column: 2nd full paragraph); ***(6)*** wherein the mixing is carried out with a high-shear mixer (Abstract; page 5968, right column: 2nd full paragraph);

(7) wherein the step of removing solvent comprises heating in vacuum (page 5968, right column: 2nd full paragraph);

(8) wherein the curing agent is selected from the group consisting of cycloaliphatic amines, aliphatic amines, aromatic amines, and combinations thereof (page 5968, right column: 1st full paragraph);

(9) wherein the curing agent is added with mixing (page 5968, right column: 2nd full paragraph);

(12) wherein the CNT-epoxy composite possesses at least one enhanced property selected from the group consisting of: mechanical properties, thermal properties, electrical properties, and combinations thereof, relative to the native epoxy (Abstract; page 5970, right column: *conclusions*); ***(13)*** wherein such enhanced mechanical properties are selected from the group consisting of an increase in Young's modulus, an increase in the tensile strength, an enhanced elongation-to-break, an enhanced load transfer to the CNTs in the composite, and combinations thereof (Abstract; pages 5967-5968: *introduction*; page 5970, right column: *conclusions*).

Sandler et al. fail to disclose the use of: ***(1)*** *functionalized* CNTs.

Tour et al. disclose that *functionalized* CNTs, which are modified with suitable chemical groups, are chemically compatible with a polymer matrix, allowing transfer of the properties of the CNTs (such as, mechanical strength or electrical conductivity) to the properties of the composite material as a whole. Furthermore, the groups can be polymerized to form a polymer that includes CNTs *(see Abstract)*. This includes thermosetting epoxy resin compositions, wherein the CNTs are chemically bound at multiple points to the cross-linked material *(see page 19, line 6 through page 20, line 25)*.

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to use *functionalized* CNTs, as taught by Tour et al., in the process of Sandler et al. because Tour et al. disclose that *functionalized* CNTs are chemically compatible with a polymer matrix, allowing transfer of the properties of the CNTs. Furthermore, the groups can be polymerized in thermosetting epoxy resin compositions, wherein the CNTs are chemically bound at multiple points to the cross-linked material.

Regarding claim 40-49, 52, 53, and 71, the combined teachings of Sandler et al. and Tour et al. are as set forth above and incorporated herein to obviously satisfy the instantly claimed CNT-epoxy polymer composite.

Regarding claim 72, the combined teachings of Sandler et al. and Tour et al. are as set forth above and incorporated herein. Sandler et al. strongly suggest the incorporation of the instantly claimed fiber reinforcements *(see page 5970, right column: conclusions)*.

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to add the instantly claimed fiber reinforcements to the combined teachings of the prior art because Sandler et al. strongly suggest the development of a conductive glass fibre reinforced composite, containing CNTs, following a methodology developed for carbon black.

5. Claims 10, 11, 50, and 51 are rejected under 35 U.S.C. 103(a) as being unpatentable over the combined teachings of Sandler et al. *(see IDS entry no. 24)* and Tour et al. (WO 02/060812 A2) in view of Stevens et al. *(see IDS entry no. 58)*.

Regarding claims 10, 11, 50, and 51, the combined teachings of Sandler et al. and Tour et al. are as set forth above and incorporated herein. Tour et al. disclose a number of suitable CNT functional groups for epoxy resin compositions, including amine groups *(see page 19, line 33 through page 20, line 14)*. However, they fail to disclose the functional groups set forth in claims 10, 11, 50, and 51.

Stevens et al. disclose *fluoro-CNTs* prepared by the direct fluorination of purified SWNTs. These *fluoro-CNTs* are then modified with heat and diamines, yielding amine

functionality on the sidewalls of the CNT *(see paragraph bridging pages 331-332)*. These materials correlate the instantly claimed embodiment set forth in claims 10, 11, 50, and 51.

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to use the instantly claimed CNTs, as taught by Stevens et al., in the combined teachings of Sandler et al. and Tour et al. because: (a) Stevens et al. disclose functionalized CNTs formed by purification, direct fluorination, and modification with heat and diamines; and (b) the teachings of Tour et al. establish that amine-functionalized CNTs are suitable for use in epoxy resin compositions.

6. Claims 14-20 and 54-58 are rejected under 35 U.S.C. 103(a) as being unpatentable over the combined teachings of Sandler et al. *(see IDS entry no. 24)* and Tour et al. (WO 02/060812 A2) in view of Stevens et al. *(see IDS entry no. 58)* and Chiang et al. *(see IDS entry no. 52)*.

Regarding claims 14-20 and 54-58, the materials of Stevens et al. also relate to the instantly claimed embodiment set forth in claims 14-20 and 54-58; however, they fail to explicitly disclose the presence of carboxylic acid groups at the *ends* of the CNTs.

The teachings of Chiang et al. demonstrate that *purified* CNTs are obviously purified by four major methods, including acid oxidation. They also disclose that this obvious technique yields carboxylic acid groups at the tube ends of the CNTs *(see page 1157, left column: third full paragraph)*. Accordingly, applying this obvious purification technique, prior to functional-ization in Stevens et al., would have yielded the dual-functionality set forth in claims 14-20 and 54-58.

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to use the instantly claimed CNTs, as taught by the combined teachings of Stevens et al. and Chiang et al., in the combined teachings of Sandler et al. and Tour et al. because: (a) Stevens et al. disclose functionalized CNTs formed by purification, direct fluorination, and modification with heat and diamines; (b) Chiang et al. disclose that purification is obviously carried out with acid oxidation, yielding carboxylic acid groups at the tube ends; and (c) the teachings of Tour et al. establish that amine-functionalized CNTs are suitable for use in epoxy resin compositions.

Claim Rejections - 35 USC § 102/103

7. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for a patent.

8. Claims 40-49, 52, 53, and 71 are rejected under 35 U.S.C. 102(a) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over Tour et al. (WO 02/060812 A1).

Regarding claims 40-49-52, 53, and 71, Tour et al. disclose a similar CNT-epoxy polymer composite *(see page 19, line 6 through page 20, line 25)*; however, they fail to disclose the process steps of the instant invention.

It should be noted that these claims are presented in product-by process format. In light of this, it has been found that, "[E]ven though product-by-process claims are limited by and defined by the process, determination of patentability is based on the product itself. The

patentability of a product does not depend on its method of production. If the product in the product-by-process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product was made by a different process," – *In re Thorpe*, 777 F.2d 695, 698, 227 USPQ 964, 966 (Fed. Cir. 1985) *(see MPEP 2113)*.

Therefore, it appears that the CNT-epoxy polymer composite of Tour et al. inherently or obviously satisfies the instantly claimed product-by-process material because the CNT-epoxy polymer composite of Tour et al. satisfies all of the material and chemical limitations of the instant invention.

Double Patenting

9. The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. A nonstatutory obviousness-type double patenting rejection is appropriate where the conflicting claims are not identical, but at least one examined application claim is not patentably distinct from the reference claim(s) because the examined application claim is either anticipated by, or would have been obvious over, the reference claim(s). See, e.g., *In re Berg*, 140 F.3d 1428, 46 USPQ2d 1226 (Fed. Cir. 1998); *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); and *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) or 1.321(d) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the conflicting application or patent either is shown to be commonly owned with this application, or claims an invention made as a result of activities undertaken within the scope of a joint research agreement.

Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

10. Claims 40-49, 52, 53, 71, and 72 are provisionally rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over the combined limitations of claims

16-22 of copending Application No. 11/632,196 (US 2008/0048364). Although the conflicting claims are not identical, they are not patentably distinct from each other because: the combined limitations of copending claims 16-22 obviously satisfy the instantly claimed CNT-epoxy polymer composite.

This is a provisional obviousness-type double patenting rejection because the conflicting claims have not in fact been patented.

11. Claims 40-49, 52, 53, 71, and 72 are provisionally rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over the combined limitations of claims 54-68 of copending Application No. 10/561,712 (US 2007/0259994). Although the conflicting claims are not identical, they are not patentably distinct from each other because: the combined limitations of copending claims 54-68 obviously satisfy the instantly claimed CNT-epoxy polymer composite.

This is a provisional obviousness-type double patenting rejection because the conflicting claims have not in fact been patented.

Allowable Subject Matter

12. Claims 21-39 and 59-70 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

13. The following is a statement of reasons for the indication of allowable subject matter:

The prior art fails to reasonably teach or suggest the embodiment set forth in claims 21 & 59 *(and dependent claims 22-31 & 60-65)*. The prior art also fails to reasonably teach or suggest the embodiment set forth in claims 32 & 66 *(and dependent claims 33-39 & 67-70)*. The reactive nature of the functionalized CNTs allows these materials to behave as reactants in the cross-linking reaction of the epoxy resin system. These particular embodiments yield a novel and chemically distinct cross-linked matrix structure upon curing.

Drawings

14. The drawings are objected to as failing to comply with 37 CFR 1.84(p)(5) because they do not include the following reference sign(s) mentioned in the description: **1801** & **1803** in Figure 18. Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either "Replacement Sheet" or "New Sheet" pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Conclusion

15. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Johnson et al. (US 2006/0155043) is related to the "P,X-reference" of the international search report. They disclose the instantly claimed method *(see paragraphs 0038-0039)*; however, the use of *functionalized* nanostructures is not supported by the parent provisional applications. Accordingly, this embodiment of Johnson et al. does not qualify as prior art.

Haddon et al. (US Pat. No. 6,368,569) disclose a functional CNT *(see claims)*, which is similar to those set forth in claims 21-31 and 59-65. However, they fail to teach or suggest the use of an acyl peroxide of dicarboxylic acid. Furthermore, they only implement mono-amines when further manipulating the functionalized CNTs.

Communication

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Michael J. Feely whose telephone number is (571)272-1086. The examiner can normally be reached on M-F 8:30 to 5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Harold Y. Pyon can be reached on 571-272-1498. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Michael J Feely/
Primary Examiner, Art Unit 1796

November 18, 2008